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AUG 17 2001

U.S. Nuclear Regulatory Commission
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10 CFR 50.73

Gentlemen:

TENNESSEE VALLEY AUTHORITY - WATTS BAR NUCLEAR PLANT (WBN) UNIT 1 - DOCKET NO. 50-390 - FACILITY OPERATING LICENSE NPF-90 - LICENSEE EVENT REPORT (LER) 50-390/2001-001

The enclosed report provides details concerning a reactor trip as a result a rise in the main condenser back-pressure. This back-pressure was caused by reduced condenser circulating water (CCW) flow due to cooling tower fill material obstructing the intake flume screens to the CCW pumps. This event is being reported, in accordance with 10 CFR 50.73(a)(2)(iv)(A), as an event that resulted in an automatic actuation of engineered safety features including the reactor protection system.

Sincerely,

W. R. Lagergren

Enclosure
cc: See page 2

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Enclosure
cc (Enclosure):
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NRC FORM 366 U.S. NUCLEAR REGULATORY COMMISSION (1-2001)

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LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
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TITLE (4)

Manual Reactor Trip Due to Reduced Circulating Water Flow

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
									NA	05000
06	29	2001	2001	-- 001 --	00	08	17	2001	FACILITY NAME	DOCKET NUMBER
									NA	05000

		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR§: (Check one or more) (11)											
OPERATING MODE (9)	1		20.2201(b)		20.2203(a)(3)(ii)		50.73(a)(2)(ii)(B)		50.73(a)(2)(ix)(A)				
POWER LEVEL (10)	100		20.2201(d)		20.2203(a)(4)		50.73(a)(2)(iii)		50.73(a)(2)(x)				
			20.2203(a)(1)		50.36(c)(1)(i)(A)	X	50.73(a)(2)(iv)(A)		73.71(a)(4)				
			20.2203(a)(2)(i)		50.36(c)(1)(ii)(A)		50.73(a)(2)(v)(A)		73.71(a)(5)				
			20.2203(a)(2)(ii)		50.36(c)(2)		50.73(a)(2)(v)(B)		OTHER				
			20.2203(a)(2)(iii)		50.46(a)(3)(ii)		50.73(a)(2)(v)(C)		Specify in Abstract below or in NRC Form 366A				
			20.2203(a)(2)(iv)		50.73(a)(2)(i)(A)		50.73(a)(2)(v)(D)						
			20.2203(a)(2)(v)		50.73(a)(2)(i)(B)		50.73(a)(2)(vii)						
			20.2203(a)(2)(vi)		50.73(a)(2)(i)(C)		50.73(a)(2)(viii)(A)						
			20.2203(a)(3)(i)		50.73(a)(2)(ii)(A		50.73(a)(2)(viii)(B)						

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
Rickey Stockton, Licensing Engineer	(423) 365-1818

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX

SUPPLEMENTAL REPORT EXPECTED (14)			EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE).	X	NO				

Abstract (Limit to 1400 paces, i.e., approximately 15 single-spaced typewritten lines) (16)

On June 29, 2001, at 1728, Watts Bar Unit 1 was in Mode 1 at 100% power. At this time the unit was manually tripped when the main condenser back-pressure reached procedure limits. The rise in the back-pressure was caused by reduced condenser circulating water (CCW) flow which resulted from cooling tower fill material obstructing the intake flume screens to the CCW pumps. All safety systems responded as required during the event. Auxiliary Feedwater initiated due to reactor trip with low Tavg, as required. All control rods inserted properly.

The root cause of this event was inadequate design output. The design allowed support schemes other than those in the issued design document to be used as needed for cooling tower fill repairs and/or replacement. The supports installed most likely failed in this event due to a combination of various loads.

Corrective actions included inspection and removal of the loose cooling tower fill material, clarification of design output, and enhanced program controls for intake flume screen cleaning.

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TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

I. PLANT CONDITION(S)

The unit was in Mode 1 at 100 % power. Plant operating temperature at the time was 588 degrees F with reactor coolant system pressure at 2235 psig

II. DESCRIPTION OF EVENT

A. Event:

On June 29, 2001, at 1728, Watts Bar Unit 1 was in Mode 1 at 100% power. At this time the unit was manually tripped when the main condenser (Energy Industry Identification System (EIIS) code COND) back-pressure reached procedure limits. The rise in the back-pressure was caused by reduced condenser circulating water (CCW) (EIIS code NN) flow which was due to several sections of cooling tower (EIIS code CTW) PVC fill material obstructing the intake flume screens to the CCW pumps. All safety systems responded as required during the event. Auxiliary Feedwater (EIIS code BA) initiated due to reactor trip with low Tavg, as required. All control rods inserted properly.

B. Inoperable Structures, Components, or Systems that Contributed to the Event:

None.

C. Dates and Approximate Times of Major Occurrences:

The following events occurred on June 29, 2001.

Time (EDT)	Activity
1000+	CCW pumps' suction pressure reported to be 3.5psig and level drop across trash rack to be ~ 1 foot.
1230	Maintenance assigned task to clean cooling towers trash racks.
1235	Maintenance conducted prejob briefing with crew
1330	Crew notified Main Control Room (MCR) that they were going to clean the cooling towers trash racks.

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Time	Activity
1335	Crew noted that the CCW inlet flume was 3 feet lower than normal. (Based on interviews this was not considered unusual based on previous experience)
1350	On lifting the U1 Rack, large pieces of the black plastic fill material were noted on the trash rack. Trash rack was lifted out of the flume and placed on the ground for cleaning. Note: due to velocity and opacity of the water, visibility is less than one foot based on the interviews with the maintenance crew. A 4-foot piece of plastic (fill) was observed by one of the crew to have passed into the Unit 1 flume.
1400	The MCR received call from the maintenance crew cleaning the cooling tower's racks that plastic tower fill material was being removed from U1 rack and communicated that an operator may want to look at the material being recovered.
1413	Maintenance notified the MCR that trash racks were cleaned.
1544	MCR received condenser vacuum low alarm. Alarm Response Instruction for low condenser vacuum and low hotwell level was entered and response taken. Hotwell makeup was taken out of automatic and put into manual due to dropping hotwell level (makeup flow increased to ~1500 gpm). Dispatched Auxiliary Unit Operators (AUOs) to investigate cause of alarm.
1545	Started C Vacuum Pump (3rd pump).
1547	Low hotwell level and low condenser vacuum alarm cleared.
1548	AUOs found no water leaks or vacuum leaks; turbine seals, boot seal, feed pumps and condensate were acceptable, no problems found.
1600 - 1615	AUOs looking for Condenser Vacuum leaks – MFWPT condenser vacuum was at 18 inches of vacuum. Normally it is at 20-21 inches of vacuum.
1630 - 1645	AUOs reported all CCW pumps at 245-250 amps on 6.9 Unit Board; changed from 220-230 amps for normal operation.

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Time	Activity
1648	1A CCW pump suction pressure started to fluctuate between 1.8 and 2.5 psig with amperage at 225 to 250. Other CCW pumps at 2.5 psig. Based on interviews, this is approximately when the operating staff became aware that a boiler maker observed a four foot section of the fill enter the Unit 1 CCW flume.
1650	Delta P on water box low, found 11 degree increase on water box outlet temperature (122 to 133 degrees) and returned to normal. CCW pump outlet pressure dropped from 43 to 28 psig then returned to 43 psig, 1A-CCW pump amps started to swing.
1655	MCR crew held briefing as contingency if rapid load reduction would be required for vacuum control. MCR supervisor discussed SOER-94-1 and the need for conservative decision making.
1709	Lowered Turbine control to get off Valve Position Limiter in preparation for load decrease and to remove 1A CCW Pump.
1710	System Engineer suggested shutting 1A-CCW Pump down while suction pressure continued to fluctuate every few seconds.
1725	CCW 1A discharge pressure swing of 15-50 psig occurred and continued for 45 seconds to 1 minute.
1727	Condenser back pressure increased to 6.5 inches Hg.
1727	Entered AOI-39 and started a load reduction at 5%/minute to remove 1A CCW Pump to drop 10% load.
1728	Manual Reactor Trip and AFW started.

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D. **Other Systems or Secondary Functions Affected:**

None.

E. **Method of Discovery:**

Subsequent to the plant event, it was determined that a number of sections of cooling tower fill material had fallen into the cooling tower basin. Several pieces of this fill material got past the intake flume screens while these screens were receiving their weekly cleaning which resulted in reducing condenser circulating water (CCW) flow.

F. **Operator Actions:**

Maintenance and Operations personnel performance during this event starting at 0900 hrs the morning of June 29, 2001, was professional and no inappropriate personnel actions were identified. However, communications between the Maintenance and Operations crews should have been clearer with respect to the quantity of debris found during lifting of the trash rack and there should have been greater sensitivity to this occurrence.

Immediate response to identify the cause(s) was taken. Main Control Room (MCR) personnel responded appropriately to the plant transient using abnormal operating instructions which address loss of condenser vacuum and rapid load reduction. Upon turbine/reactor trip, Operations entered: 1) Emergency Procedure (E-0), Reactor Trip or Safety Injection, 2) ES-0.1, Reactor Trip Response, AOI-17,Turbine Trip Response and 3) General Operating Instruction GO-5,Shutdown from 30% Power to Hot Standby and GO-6, Shutdown from Hot Standby. Emergency and abnormal procedures were correctly followed, and the plant was placed in a stable condition in Mode 3.

The operators demonstrated a conservative decision making process in response to the initial symptoms of decreased CCW flow and increasing condenser back-pressure. In review of the pre-trip parameter trends, it is concluded that the operating staff believed the plant had been restored to a normal parameter values about 1550 on June 29 (after the third condenser vacuum pump was started). The operators took appropriate action in manually tripping the reactor based on the reaching the condenser back-pressure limit.

G. Safety System Responses:

All safety systems responded as required during the event. Auxiliary Feedwater initiated due to reactor trip with low Tavg, as required. All control rods inserted properly. See the Analysis Of The Event and Assessment Of Safety Consequences sections below for further discussions.

III. CAUSE OF THE EVENT

A. Immediate Cause:

The unit was manually tripped when the main condenser back-pressure reached limits required by procedure. The rise in the back-pressure was caused by reduced condenser circulating water (CCW) flow which resulted from cooling tower fill material obstructing the intake flume screens to the CCW pumps. All safety systems responded as required during the event.

B. Root Cause:

The root cause of this event was inadequate design output. Note 2 of Design Change Notice (DCN) R39027 (R-type), issued in 1996, allowed support schemes other than those in the issued design document to be used as needed for cooling tower fill repairs and/or replacement. This output (note 2) was referenced in the work order for support installation following failure of a concrete beam in the Fall of 2000. Supports installed at that time did not agree with existing details. However, based on design output, no approval was needed to deviate from the design output details. The supports installed at that time (U1C3 outage) are the same supports which failed, leading to this event. The most probable cause for that failure was a combination of deadweight loads from the fill, operating loads due to the water spray, loads from fallen drift eliminator panels, and loads due to differential movement of the cooling tower structures, leading to failure of the anchorage points.

C. Contributing Factor:

The communication between the craft performing the screen cleaning activity and the operations personnel in the MCR may have contributed to the delay in recognizing the source of the rise in condenser back-pressure.

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IV. ANALYSIS OF THE EVENT

The immediate post-trip response of the reactor and the associated safety systems were as expected.

The CCW pumps exhibited erratic motor amps, flow, head, and power prior to the manual reactor trip. The cause of this condition was low suction pressure due to PVC fill obstructing the intake flume screen. This condition was common to all 4 pumps and was most significant on 1A CCW pump due to suction conduit arrangement. Following the reactor trip, the 1A CCW pump was returned to service and operating parameters did not indicate damage to the pump.

The effect of elevated C Zone Condenser back pressure on C Low Pressure Turbine was evaluated and it was determined that the cumulative effect of the back pressure exceeding 6.2 inches Hg does not require immediate non destructive examination prior to returning the turbine to operation.

A post-trip inspection of the Turbine Building piping was performed by Civil Engineering following the event. No significant structural damage due to unanticipated transient events occurred.

An inspection of the Unit 1 Cooling Tower was performed by Civil Engineering and found that the tower was structurally sound apart from the failed fill supports.

V. ASSESSMENT OF SAFETY CONSEQUENCES

In response to plant status, the Operations personnel manually tripped the reactor, which initiated a turbine trip. Operators responded in accordance with Emergency Operating Instructions E-0, Reactor Trip; ES-0.1, Reactor Trip Response; AOI-17, Turbine Trip. The action of the operators was consistent with plant protection and the proper control of plant cooldown.

There were no safety implications to the public related to the event. The only ESF equipment actuation was an AFW start on the reactor trip concurrent with low Tavg, as required which meant that immediate post-trip heat removal was accomplished via the normal method using auxiliary feedwater through the normal heat removal path which consists of the main condenser. Although not utilized during the post-trip recovery, the standby main feedwater pump was available following FWI reset.

FSAR section 15.2.7 describes the LOSS OF EXTERNAL ELECTRICAL LOAD AND/OR TURBINE TRIP event. The plant trip on June 29, 2001, was less challenging than and bounded by the event described in the FSAR. The following plant conditions were bounded by the event described in the FSAR:

1. Reactor power was equal to or less than the analyzed value used in the FSAR.

2. Reactor control was in automatic versus manual as described in the FSAR.

3. Steam dumps operated as designed. The FSAR does not take credit for their use.

In summary, the reactor trip was manual. The reactor trip resulted in a turbine trip and station power was not lost during the event. The plant response remained within the FSAR boundary analysis. The pressurizer power operated relief valves and safeties were not required to limit Reactor Coolant System (RCS) (EIIS code AB) pressure. Similarly, the steam dumps and AFW operated as required so that steam generator power operated reliefs was not required. RCS pressure and loop average temperatures decreased during the transient rather than increasing as predicted by conservative FSAR assumptions. These differences between the FSAR and the plant event are associated with the conservatism of the FSAR analysis and the actual plant event which was quickly brought to a stable condition.

VI. CORRECTIVE ACTIONS

A. Immediate Corrective Actions:

These following actions are tracked under the TVA's corrective action program and therefore, are not considered to be regulatory commitments.

Operations responded to the plant transient in accordance with appropriate plant procedures.

Subsequent to the event, the Unit 1 Cooling Tower Basin and intake flume were inspected and the PVC fill removed. The Unit 1 Cooling Tower was inspected to identify other loose or poorly supported fill material. The identified material was removed. In addition, the west waterbox was drained and inspected for PVC fill material. No significant accumulation was observed.

The 1A CCW pump and motor were verified to be operating satisfactorily based upon observation of motor amps, suction pressure, flow, bearing and winding

temperatures.

Non-licensed assistant unit operator (NAUO) rounds for the outside routine were revised to define criteria for requiring the cooling tower trash rack to be cleaned. In addition, a preventative maintenance instruction was issued to provide steps for cleaning of the trash racks and to define a criteria for level drop across the trash rack at which Operations must concur with the removal of the rack for cleaning.

A site bulletin was issued on sensitivity to communications in which abnormal parameter values or observations are being communicated.

A memorandum was issued to brief design engineering personnel which addresses lesson learned from this event with respect to design engineering practices.

The design control process no longer allows R type DCNs. However, a review of other R-DCNs issued during this time was completed with no other similar issues identified.

B. Corrective Actions to Prevent Recurrence:

These following actions are tracked under the TVA's corrective action program and therefore, are not considered to be regulatory commitments.

A design change notice will be issued to clarify the design support requirements for fill material support and for trash rack extension modifications. At the appropriate time, the missing fill material will be restored to the Unit 1 Cooling Tower with adequate support features approved by TVA Engineering.

VII. ADDITIONAL INFORMATION

A. Failed Components:

The root cause of the event was determined to be inadequate design output that led to cooling tower fill material supports installed in 1996 to fail, leading to

this event. The most probable cause for the failure was a combination of deadweight loads from the fill, operating loads due to the water spray, loads from fallen drift eliminator panels, and loads due to differential movement of the cooling tower structures, leading to failure of the anchorage points.

B. **Previous LERs on Similar Events:**

A review of previous reportable events for the past three years was performed. This manual plant trip was necessary due to low condenser vacuum caused by the presence of fill material obstructing the intake flume screens to the CCW pumps. Although the physical cause of low condenser vacuum was unique to this event, WBN has experienced low condenser vacuum resulting in reactor trip in two other LER instances. These two other events are summarized below:

1) Trip date March 13, 1996 - LER date April 11, 1996

   Flow blockage through main condenser due to buildup of non- condensables because MFPT 1B sealing steam building up and being drawn into vacuum pumps.

2) Trip date February 19, 1996 - LER date March 21, 1996

   Faulty hotwell indication and control resulting in insufficient makeup to hotwell.

Based on the review of the above LER, the failure mechanisms of this event and the previous events are not similar.

C. **Additional Information:**

None

D. **Safety System Functional Failure:**

This event did not result in a safety system functional failure in accordance with NEI 99-02, Section 2.2.

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E. Normal Heat Removal

This event did not result in the loss of normal heat removal in accordance with NEI 99-02, Section 2.1.

VIII. COMMITMENTS

None.